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ABSTRACT

The relationship between American College Testing Program (ACT) and California Test of Mental Maturity (CTMM) scores were explored. Four hundred and thirty-four undergraduate subjects of both sexes were selected from a midwestern university. Pearson product moment correlation (r) and Kendall rank correlation coefficient (tau) were used to measure correlations between each standard ACT score and each CTMM score. Factor analyses were performed on several combinations of test scores and subscores. The correlation data suggest that, although the two tests do not approach perfect correlation, they do load significantly on only one factor. Therefore, this study suggests that both the ACT tests and the CTMM are unidimensional scales measuring a common quality which could plausibly be labelled mental ability. (Author/PN)

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American College Testing Program Scores as an Index of Intelligence

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Abstract

The present study explored the relationship between American College Testing Program (ACT) and California Test of Mental Maturity (CTMM) scores. Four hundred and thirty-four undergraduate subjects of both sexes were selected from a midwestern university. Pearson product moment correlation (r) and Kendall rank correlation coefficient (tau) were used to measure correlations between each standard ACT score and each CTMM score. Factor analyses were performed on several combinations of test scores and subscores using the BMD (Dixon, 1975) program. The correlation data suggest that although the two tests do not approach perfect correlation, they do load significantly on only one factor. Therefore, this study suggests that both the ACT tests and the CTMM are unidimensional scales measuring a common quality which could plausibly be labelled mental ability.

Abstract

Relationships between American College Testing Program (ACT) and California Test of Mental Maturity (CTMM) scores were studied. The results suggest that although the tests do not approach perfect correlation, they do load significantly on only one factor, suggesting that both are unidimensional scales measuring a common quality which could plausibly be labelled mental ability.

Introduction

The American College Testing Program tests "are constructed to assess each student's general educational development and ability to complete college-level work." (The American College Testing Program, 1978, p. 2). Since ability to do college-level work is closely related to intelligence, this statement of purpose from the producers of the American College Testing Program tests suggests that these scores are intended to be used as quasi measures of intelligence.

A search of the literature yielded only one study which actually compared American College Testing Program scores with scores obtained on traditional measures of intelligence.

Martin and Rudolph (1972) correlated scores on the Slosson Intelligence Test (SIT) with Wechsler Adult Intelligence Scale (WAIS) scores and American College Testing (ACT) scores. Since the purpose of their study was to validate the Slosson Intelligence Test, they did not correlate WAIS scores directly with ACT scores. Using a sample of 50 undergraduate psychology students they found a correlation (r) of .70 ($p < .01$) between WAIS full scale and SIT scores. Since ACT scores could not be obtained for all the members of the sample, only 41 subjects were available for

the comparison between SIT and ACT scores. This comparison resulted in a correlation (r) of .56 ($p < .01$).

Purpose

The purpose of the present study was to explore the relationship between ACT scores and CTMM scores. A correlational study was carried out in order to discover the strength of the relationship between each of the scores and subscores. Factor analyses were conducted in order to explore the question of whether the various scales are multidimensional or unidimensional.

Methodology

Four hundred and thirty-four subjects were chosen from the files of a midwestern university counseling and testing center. These subjects were all of those cases in the file for whom both ACT scores and CTMM scores were available. The ACT test is required of all American students entering the university as freshmen; however, the CTMM is required for entrance to a limited number of curricula. For this reason approximately one file in six contained both tests. The tests were administered during the six years between 1971 and 1977. All subjects were students at the university when the CTMM tests were administered. ACT tests were taken at various times ranging from the third year in high school through the beginning of the freshman year in college.

Statistical Analyses

Both the Pearson product moment correlation (r) and Kendall rank correlation coefficient (tau) were used to measure the degree of correlation between each standard ACT score (English, Mathematics, Social Studies, Natural Science, and Composite) and each CTMM score (Language I.Q., Non-Language I.Q., Total I.Q., Language Raw Score, Non-Language Raw Score, and Total Raw Score).

Pearson r assumes an underlying interval scale whereas Kendall's tau is appropriate for ordinal data. The Kendall rank correlation coefficient is more sensitive than a Spearman rank correlation coefficient for data which include a large number of ties and was preferred over the Spearman rank correlation coefficient because of the large number of ties in the present data. The Kendall rank correlation coefficient yields different numerical values than Spearman rank correlation coefficients for the same pair of rankings. This is due to the fact that the two tests have different underlying scales. It will be noted, however, that the two tests use the same amount of information from the data and, therefore, could be expected to have the same power to detect the existence of an association in the population.

Kendall's tau has a power efficiency of 91 percent. Thus, tau is approximately as sensitive a test of association between

two variables in a bivariate normal population with a sample of one hundred cases as is the Pearson r with ninety-one cases (Siegel, 1956). If one concludes that the data are ordinal, Kendall's tau is preferable to the Pearson r.

Factor analyses were performed on several combinations of test scores and subscores using the BMD (Dixon, 1975) factor analytic program. Varimax rotations were performed. Unities were employed as estimates of communality.

Results

Table 1 shows the Kendall Rank Correlation Coefficients (tau) obtained between ACT scores and CTMM scores.

Insert Table 1 about here

Table 2 shows the Pearson r intercorrelation matrix for ACT scores and CTMM scores.

Insert Table 2 about here

The highest correlation obtained in the Pearson r analyses is .19 higher than that obtained by means of Kendall's tau. Since it could well be argued that the data are ordinal rather than interval, the more conservative correlations obtained using Kendall's

tau may well be more accurate.

An examination of Tables 1 and 2 shows that the strongest correlational relationship exists between CTMM Total I.Q. and Composite ACT scores (tau = .60, r = .79, significant at the .001 level).

In order to explore the relationship between scores on both tests from various viewpoints, factor analyses were performed on several different combinations of subscores and total scores. Tables 3, 4, and 5 show the factor loadings obtained for the various combinations of scores. According to Kaiser's criterion, all factors with a latent root (eigenvalue) of 1.0 or less may be disregarded when unities are employed in the diagonal. On the basis of this criterion, only one factor was rotated. Application of Cattell's scree test added further support to the single factor solution. It is of interest to note that the single factor solution holds regardless of the combination of scores and subscores examined.

Table 3 shows the factor loadings for each of the subscores for both ACT and CTMM. Each of the variables loads on the factor at a level exceeding .75. The factor accounts for 67 percent of the total variance.

Insert Table 3 about here

Table 4 shows the factor loadings for each of the ACT standard subscores and the CTMM Total Raw Score. Each of the variables loads on the factor at a level exceeding .75. The factor accounts for 72 percent of the variance.

Insert Table 4 about here

Table 5 shows the factor loadings for the composite standard ACT scores and the CTMM subscores. Each of the variables loads on the factor at a level exceeding .75. The single factor accounts for 78 percent of the total variance.

Insert Table 5 about here

Discussion

The correlation data suggest that the standard composite ACT score, which correlates with CTMM Total I.Q. at the .60 level is the most appropriate of the ACT scores for use as an indicator of intelligence. The fact that the correlation is no greater than .60 suggests that there is considerable material which is not

common between the two tests. That is to say, each test measures something which is not measured by the other.

The results of the factor analyses suggest that even though the two tests do not approach perfect correlation, they do load significantly on only one factor. Thus, it appears that even among those elements which do not correlate there is considerable loading on the single factor. This further suggests that each of the scales is unidimensional rather than multidimensional.

Conclusions

The results of this study suggest that both the ACT tests and the CTMM are unidimensional scales measuring a common quality which could plausibly be labelled mental ability. Both the correlational data and the factor analyses support the notion that there is considerable similarity between the two tests. On the other hand, there is also evidence that each test measures some aspects of mental ability not measured by the other.

It is beyond the scope of the present study to identify the nature either of the common quality measured by both scales or of the unique qualities measured by each scale. Possibly comparison of scores from both scales with a more sophisticated instrument such as the Wechsler Adult Intelligence Scale would provide additional information regarding the nature of these qualities.

Table 1

Kendall Rank Correlation Coefficients (tau) between American College Testing Program (ACT) Standard Scores and California Test of Mental Maturity (CTMM) Scores*

CTMM Scores	English ACT	Math ACT	Social Studies ACT	Natural Science ACT	Composite ACT
Language					
I.Q.	.48	.38	.50	.47	.56
Raw Score	.48	.38	.51	.48	.56
Non-Language					
I.Q.	.37	.37	.39	.42	.47
Raw Score	.37	.37	.39	.43	.47
Total					
I.Q.	.49	.43	.52	.52	.60
Raw Score	.49	.43	.51	.52	.60

*All correlations significant at .001 level

Table 2

Pearson Product Moment Correlations (r) for American College Testing Program (ACT) Standard Scores and California Test of Mental Maturity (CTMM) Scores*

CTMM Scores	English ACT	Math ACT	Social Studies ACT	Natural Science ACT	Composite ACT
Language					
I.Q.	.66	.53	.68	.64	.74
Raw Score	.67	.54	.69	.65	.75
Non-Language					
I.Q.	.55	.53	.55	.60	.66
Raw Score	.55	.52	.55	.60	.66
Total					
I.Q.	.69	.60	.70	.70	.79
Raw Score	.69	.60	.70	.70	.79

*All correlations significant at .001 level

Table 3

Factor Loadings on Orthogonal Single Factor Solution for ACT Standard Subscores and CTMM Raw Subscores

Variable	Factor I				
English ACT	.83				
Math ACT	.76				
Social Studies ACT	.86				
Natural Science ACT	.86				
CTMM Language Raw Score	.84				
CTMM Non-Language Raw Score	.77				
Eigenvalues	4.05	.51	.49	.36	.33
Cumulative Percentage of Variance	.67	.76	.84	.90	.96

Table 4

Factor Loadings on Orthogonal Single Factor Solution for ACT Subscores and CTMM Total Raw Score

Variable	Factor I				
English ACT	.84				
Math ACT	.77				
Social Studies ACT	.87				
Natural Science ACT	.87				
CTMM Total Raw Score	.87				
Eigenvalues	3.59	.49	.36	.30	.27
Cumulative Percentage of Variance	.72	.81	.89	.95	1.00

Table 5

Factor Loadings on Orthogonal Single Factor Solution for Standard Composite ACT Scores and CTMM Raw Subscores

Variable	Factor I		
Composite ACT Score	.91		
CTMM Language Raw Score	.89		
CTMM Non-Language Raw Score	.84		
Eigenvalues	2.33	.42	.24
Cumulative Percentage of Variance	.78	.92	1.00